Trends in Rail Transport in Zambia and Tanzania

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Rail transport in Africa began in the colonial days. The lines were built partly for military reasons and partly to allow exploitation of mineral deposits, export of farm products, and import of manufactured goods. Built inland from the coast, they were not designed for inter-country trade nor were they ideal for internal economic development. They were built cheaply, and to a narrow gauge of 1.067 meters (3½ feet) in the British colonies (but not in all) and I meter in most others. After independence one major line (Tazara) was built, some lines were extended, and some connecting links built. On the whole, however, despite some improvements, in many respects most systems have deteriorated in recent decades. It is the purpose of this paper to review the recent experience in detail in Zambia and Tanzania

Zambia Railways

Much of Zambia has never had rail service. The Zambia Railway line was built by Rhodesian Railways, crossing the Zambezi at Victoria Falls near Livingstone in 1903, reaching Kabwe (then Broken Hill) in 1906, and Copper Belt (then little developed) in 1909. Commercial agriculture, trade and industrial activity concentrated along the 'line of rail'; the geographical pattern of economic development was influenced by the railway perhaps more than in any other country. The mainline extends roughly 1,000 km northerly from the river crossing to the Copper Belt, connecting with Tazara at Kapiri Mposhi and with the Zaire rail system at the border. Apart from branches in the Copper Belt, the only other branch reaches the coal mines at Maamba. The line from Livingstone to Mulobezi, serving the sawmill, is operated by Zambia Railways for the government. Fig. 1 P.58 shows the line and those of neighbouring countries.

While there is considerable in-country traffic in coal, maize, and other goods, much of the traffic is to or from the ports. Table 1 shows the changing patterns of the handling of import and export traffic. Originally, most was channeled through Rhodesia and virtually all by rail. A portion, particularly import traffic, went via the Benguela Railway to the Atlantic port of Lobito. With UDI in Rhodesia and the eventual closing of the border, a substantial portion was shifted to Dar es Salaam, first by road, then with the completion of Tazara, primarily by rail. After 1976, the Lobito route, the best in many ways for merchandise imports, was closed because of the war conditions in Angola and had

not started functioning by 1984. But with independence in Zimbabwe, use of the southern route resumed, particularly because of problems with TAZARA and the Port of Dar es Salaam. Thus, in recent years, while TAZARA handles the bulk of the export traffic, the import traffic is divided about equally between the Dar route and that via Zimbabwe. The use of TAZARA is of course disadvantageous to Zambia Railways on the Copper Belt traffic, since it has only a very small portion on the total haul. There is considerable road transport competition, with increasing amounts on the southern routes. For traffic between Harare and Lusaka and the Copper Belt, the road mileage is substantially less than the rail mileage. The inability of the railway to handle all the traffic available, particularly in maize, has of course increased the relative importance of road transport. Nevertheless, rail remains the dominant form of transport. Unlike the Zimbabwe situation, much road transport was handled by two large parastatals, the defunct Zambia-Tanzania Road Service and Contract Haulage.

Table 1

Percentage of Zambia Import and Export Traffic via Various Routes Selected Years 1953-1981

	1953	1963	1967	1972	1973	1975	1976	1979	1980	1981
Export										
Lobito-Zaire (rail)	0	0	23	20	54	40	15	7	6	4
Dar es Salaam (road and rail)	0	0	31	26	35	51	75	52	59	66
Malawi (road)	0	0	8	1	5	9	5	2	5	—
Mozambique (road)	0	0	0	0	0	1	4	0	0	0
Zimbabwe(rail and road)	100	100	34	54	1	0	0	38	34	29
Kazangula (road)	0	0	0	0	0	0	0	neg	0	0
Kenya (road)	0	0	0	0	6	neg	1	.0	0	0
Air freight	0	0	5	neg	0	0	0	1	.5	.6
Imports										
Lobito-Zaire (rail)	—	—	—	11	49	29	neg	neg	neg	0
Dar es Salaam (road and rail)	—	—	—	19	23	43	76	47	47	46
Malawi (road)	—	—	—	0	13	13	9	4	4	.5
Mozambique (road)	—	—	—	0	0	3	8	3	0	2
Zimbabwe(rail and road)	—	—	—	66	4	0	0	44	51	50
Kazangula (road)	—	—	—	neg	1	5	1	.2	0	neg
Kenya (road)	—	—	—	0	8	3	3	0	0	0
Air freight	—	—	—	1	3	2	3	3	2	2

Dar es Salaam route traffic was all road until 1975, about equal rail and road 1976 and predominantly rail since.

The Mozambique figure does not include traffic via Zimbabwe to Mozambique ports.

Sources: *Annual Reports*, Bank of Zambia.

Table 2 shows the relative division of import and export traffic between road and rail in three recent years.

The railway handles substantial transit traffic between Zaire and the countries to the south, copper for export via South Africa and maize from Zimbabwe and South Africa. This traffic continued during the period in which Zambia closed the border with Rhodesia to its own trade. Two passenger trains a day are operated on the line, from the Copper Belt through Lusaka to Livingstone.

Table 2

Foreign Trade by Mode of Transportation (metric tons) 1979-1981

	1979		1980		1981(a)	
	Total Trade	Percent	Total Trade	Percent	Total Trade	Percent
Road	364,627	24.7	447,037	26.8	305,499	
Rail	1,090,320	74.1	1,200,720	71.9	1,070.909	76.9
Airfreight	12,010	1.2	23,143	1.3	16,503	1.2
TOTAL	1,471,957	100.0	1,670,900	100.0	1,392,911	100.0

Source: Bank of Zambia *Annual Report* 1981.
Including lube oil.

The railway has had difficulties in handling the available freight traffic ever since its formation from Rhodesian Railways, despite substantial Canadian management and training assistance at times and three World Bank loans. The track and signalling systems are superior to those of most tropical African countries. The major problems has been inadequate trained staff and shortages of locomotives and freight cars. The entire system is dieselised; but maintenance has not been adequate, and exchange problems have created the usual shortage of spare parts. There has been a constant shortage of freight cars; the railway in part blames this on TAZARA, on which turnaround time has been very slow, and at times numbers of cars have been locked in Angola. On the other hand, the system has far more South African Railways cars, some 2400, more than the agreed upon limit of 1648.

There was some improvement in 1982, and the traffic does move, but the line is not operated to its potential capacity.

Despite its operational difficulties, Zambia Railways has managed to show an operating surplus, including depreciation in cost, except in 1975 and 1981. The 1981 loss, of K 1.9 million, was due to the inability to raise rates sufficiently to offset higher costs. Rate changes require government approval even though the railway is a statutory corporation. But interest costs are not covered.

There have been long standing plans for additional railroad construction in the country, particularly to connect with the Malawi system west of Lilongwe

and with the Mozambique system at Tete. Currently, the Malawi line is being extended to the border, and Zambia is building from the border to Chipata, one of the major cities in the country without rail service. But a long gap will remain before this is connected with the Zambia network.

Tanzania-Zambia Railway

Tanzania-Zambia Railway (TAZARA) consists of one line extending 1,885 km (1,158 miles) from a connection with Zambia Railways at Kapiri Mposhi to the harbour at Dar es Salaam, with 1.067 m. guage. It serves Mbeya, one of the major towns in Tanzania not previously served by rail, but not Iringa, the other major town in southwest Tanzania; much of the area served is relatively undeveloped. To date the line has handled primarily Zambia traffic, copper outbound, fertilizer, grain and manufactured goods inbound. The line, built by China and completed in 1975, was one of the major rail construction projects in the last century and freed Zambia of dependence on the southern route.

But in terms of performance it has been a disappointment. It has handled a substantial volume of traffic more cheaply than road transport, but not to the extent anticipated. It is difficult to get adequate scientific explanations of the problems, some of the track was not well located in terms of water runoff. The basic trouble appears to be inadequate trained personnel, particularly for management and equipment maintenance. It has been constantly short of locomotives, which have not been maintained well. They are diesel hydraulic, rather than diesel electric, and neighbouring roads cannot assist. Train delays have been serious, with a very slow turn-around time, tieing up its own and Zambia Railways freight cars. Part of the trouble has arisen from congestion at the port of Dar es Salaam and the delays in clearing Zambia-bound traffic because of lack of foreign exchange. The line has been so short of personnel and equipment that at times it has suspended passenger service entirely or sometimes running this service only once a week. The line has great potential and

Table 3

Tazara Freight Rates (Tshs/ton) (1981)

Scale	100 km	200 km	500 km	1000 km	1500 km
1	189	272	417	637	857
2	168	231	361	566	771
3	152	199	316	505	694
4	136	178	293	458	620
5	121	162	259	411	562
6	110	151	235	360	486
7	100	139	220	343	463
8	89	124	195	310	423
9	79	112	176	280	386
10	73	104	167	265	383
11	37	65	143	261	376

Passenger fares are based on a straight mileage basis, class 1, 30tc per km, 2, 16.5 tc, 3, 7.5 tc. The second and third class rates are about 25% greater than those of Tanzania Railways.

will be of growing importance for Central Africa, but currently, it has a long way to go before being an efficient operation.

The line had about 2200 freight cars and 100 diesel locomotives, with a staff of about 10,000. In recent years it has averaged about 1 million tons of freight (900 million ton kilometres), about 495,000 ton km/km or the same ton miles per mile and carried about 1.3 million passengers a year.

The tariff structure is the old value of service type, adapted in part because much of the traffic is not vulnerable to road transport competition. The copper traffic allocation is controlled by the government of Zambia. Commodities are classified into 11 categories, the bulk agricultural commodities falling into the 11th class (lowest rate). The rates tapersubstantially but not to the extent found in many countries. The scale of rates, as of 1981, is shown in table 3 in Tanzania shillings. Copper, in scale 6, bears a relatively high rate, about 5 US cents per ton mile.

Tanzania Railways

The principal railway system of Tanzania is the Tanzania Railways Corporation (TRC), with 2800 km of meter gauge track and 16,000 employees.

Lines

There are two distinct lines, with a connecting link between them (Figure 2). The principal portions of both were built by the German colonial administration prior to World War I.

1. The Tanzania Central line, extending from Dar es Salaam west-ward via Morogoro, Dodoma and Tabora to Kigoma on Lake Tanganyika was completed in 1914 and is 1,255 kilometers long. This is by far the heaviest traffic line. There are three branches.
   (a) Tabora-Mwanza, on Lake Victoria 379 km, started in 1914-15, completed in 1928, also a heavy volume route.
   (b) Tabora south to Mpanda, 213 km, built in 1947.
   (c) Kilosa south to Mikumi (1958) and on to Kidatu (1965) where it almost touches TAZARA, 108 km.
2. The Tanga line, 437 km, begun in 1895 (thus the oldest in the country), reaching Moshi in 1911 and extended to Arusha in 1929.

These are connected by the Link line, Ruvu to Mnyusi, built in 1963, 188 km. Before that time the lines were not connected.

There is an unused segment, 31 km, between the Tanga line and the Kenya border, cut with the closing of the border. This line, if operating, would allow through services from Nairobi to Dar es Salaam.

Two lines have been abandoned: an extensive network in the south extending inward from Mtwara on the southern coast built as a part of a groundnut scheme and abandoned following the collapse of the scheme, and a line to Kinyangari in Singida district, abandoned after less than 20 years because it generated so little traffic.

Management of the system was united with the Kenya-Uganda lines in 1948, to form East African Railways, but this was dissolved in 1977 following the breakup of the East African Community.

An intensive study of the system has recently been completed by the Canadian International Development Agency (CIDA).[2]

The Physical Plant

In general, the physical plant is in fair condition and traffic does move; derailments have increased but are not frequent. But, as noted subsequently, there are serious limitations which make it impossible to move all available traffic.

Rail: The largest segment of track has had 60 pound rail, the central line to milepost 310, the Mwanza branch and the line from Tanga to Moshi. The remainder of the main line is 56 pound rail, the original rail laid by the Germans 1908-1914, with the original steel sleepers. The portions from Moshi to Arusha and the Mpanda branch have 45 and 50 pound rail, as does part of the link line. These are the three weak segments not capable of handling the larger diesels, a problem of particular seriousness on the link line. The rail is surprisingly in good condition, though a third is over 70 years old, with some parts worn out. The CIDA study recommends the installation of 80 pound rail on the entire main line and 60 pound rail on the others, to allow freight train speeds up to 45 MPH. A portion of the main line has already been changed.

Most lines have gravel ballast (Mpanda is an exception) but it is in bad shape in many areas. The link line is particularly troublesome because it runs through swampy areas.

There are typically 2,240 ties (sleepers) per mile, primarily steel. Consideration is given to concrete ties, which lessen the drain on foreign exchange; they are satisfactory if rails are welded and the joints staggered.

The maximum grade is 2.2% against west bound traffic, between Dar es Salaam and Morogoro, the heaviest traffic portion of the line. The sharpest curve is 8°. One portion of the line in the far west is subject to flooding.

Locomotives: As of mid-1982, the line had 116 diesels of 9 different types, from Germany, the U.K., India, and Canada. The newest and largest by mid 1982 were the MLW built (Canada). The diesels are as follows:

Class	HP	Number
88	2050	35
87	1840	8
73	1380	15
72	1240	2
64	760	24
Other	320 or less	32

The line still has a number of steam locomotives, reported as 63 in 1979. These were being used in some line service as late as 1980; currently they are used only for switching, in Morogoro, Tabora, and a few other locations. Most are in a bad state of repair. The present plan is to phase them out as soon as possible, but there is some thought of keeping and rebuilding the best ones. They are oil burners, and there would be little gain in keeping them unless they were converted to coal.

Typically, one diesel is used on a freight train, 28 cars (1,350 tons) being the train length limit up to Morogoro, as the couplers will not stand longer trains. But two diesels are frequently used to Morogoro and sometimes beyond. All trains on the main line change engines in Morogoro, location of the diesel shops, and Tabora. The Morogoro shops are new and not fully operative, mostly for lack of personnel. The diesel repair shops of East African Railways were located in Nairobi; when the system split up, TRC was left without such facilities until the new shops were built.

Typically only about 60% of the road engines and 51% of the switchers are available for service, a very low figure by comparison with most railroads, due to lack of trained personnel and spare parts.

Freight Cars: The line has some 3,800 cars (wagons); 800 of these are the old, short, two axle cars. About 70 per cent of all cars are in good or excellent condition. The cars are air brake equipped, but the couplers are not automatic. Average capacity is 33 to 38 tons. The use of automatic couplers would allow longer trains, but the CIDA study concludes that the change would not be economic. Average turn-around time for freight cars is 21 days.

The line has a total of 165 passenger cars, over 30% of which are more than 30 years old. There are not nearly enough cars to handle the number of persons seeking to travel. A total of 110 cars are on order; a number from Sweden were delivered late in 1982.

Containerisation: While there is no piggyback operation the use of containers has been growing. They are particularly important for the cross-lake transit traffic, simplifying the loading and unloading. They are also used extensively for transporting up-country construction materials, and for export of tobacco.

Standard flat cars are still used for the containers.

Operation

Freight trains are usually operated with a crew of 2, passenger trains, 3. Train speeds are limited to 35 mph, but with many 10 mph slow orders. On most of the system, a token technique is used to control train movements. When a train enters a segment of line, the engineer receives a metal token from a mechanism connected to the next station by wire: when he has done so, the token at the next station cannot be removed until the train has cleared. This is a virtually foolproof system to avoid train collisions but does not function when the wire communications are not operating. There is no signal system; control is entirely through the stations. The only exception to the use of the tokens is on the lines from Tabora to Kigoma and Mpanda, operated with a paper train order system.

Passenger service is operated daily on the two main lines. On the central line, the train leaves Dar es Salaam at 7 p.m. arrives in Dodoma the next morning, Tabora in the evening, and Kigoma and Mwanza the next morning, averaging about 20 mph. Three classes are provided and reservations are required for 1st and 2nd classes. Daily service is operated from Dar to Moshi, but not to Arusha.

In 1979, passenger train on time performance was 27%, but the present figure is reported to be better.

Non-rail Operation

TRC operates vessels on Lakes Victoria and Tanganyika, including a 42-car ferry from Mwanza to Bukoba and Musoma, which do not have direct rail service. Only the old Liemba, a passenger vessel, is operated by TRC on Lake Tanganyika, but private carriers provide service across the lake.

The system operates road transport service from Dar es Salaam to Iringa

and Mbeya, Iringa to Moshi, and Mwanza to Bukoba. Luxury bus service is operated to Iringa and Mbeya, but most regular bus service is provided by private firms.

Freight Rates

The East African Railway tariff was of the traditional value of service type with low rates on farm products and export traffic. After TRC was formed, a completely new tarrif was developed, based strictly on cost of handling differences. There are only four classes of commodities, based on loading characteristics: LCL, 2: 10 ton loads, 3: 25 ton loads, 4:30 tons and over. Rates taper with distance but not to the extent in the US. Average rates are shown in tables 3 and 4, together with rates per ton/km and a comparison with TAZARA rates. On the more valuable commodities, TRC rates are much less; on less valuable commodity, shorter distance shipments, the rates are higher. In general, as the table indicates, TRC rates are lower than those of TAZARA (Table 4).

Table 4
Tanzania Railway Rates 1981

TRC General Goods Rates (TShs/ton except containers)

Scale	100 km	200 km	500 km	1000 km	1500 km
1	126	144	211	389	567
2	89	103	186	289	389
3	53	89	161	248	348
4	45	85	142	228	329
Livestock	55	67	103	165	226
Petrol	36	70	143	286	435
Containers*	980	1200	1850	3100	4500

*Total charge.

TRC General Goods Rates (Tshs/ton-km

Scale	100 km	200 km	500 km	1000 km	1500 km
1	1.26	.72	.42	.39	.38
2	.89	.52	.37	.29	.26
3	.53	.45	.32	.25	.23
4	.45	.43	.28	.23	.22

One consequence of the cost-based tariff is that the rate as percentage of the selling prices of the goods is very low on valuable goods; examples for typical distances include 1% on coffee and 2% on petroleum products, vs. 14% on sorghum and 23% on cement. This type of tariff lessens the danger of loss of traffic to motor transport and is basically economically justified but it does sacrifice potential revenue on the high value commodities so long as they stay on rail.

In general, rail rates are lower than truck rates for distances over 150 to 200 km. Typical figures are as follows:

Rate Ts per ton

	Distance (km)	Rail	Truck
Dar es Salaam-Morogoro	202	90	150
Dar es Salaam-Arusha	637	165	350
Dar es Salaam-Mwanza	1229	276	1500

The CIDA study concludes that truck costs are 3 to 7 times the rail costs except on the shorter hauls. But truck time is much faster; for example, on a long haul, 4 days (despite poor roads) vs. as much as 30 days. CIDA studies conclude that even with adjustments for time differences, rail is still relatively cheaper.[3]

Traffic Flows

As shown in Figure 2, the main line from Dar es S alaam (where 50% of the traffic originates) to Tabora has the heaviest flow, with the Morogoro-Ruvu (junction point for the link line) portion the heaviest segment on that line. Beyond Tabora, the Mwanza line has some what heavier traffic than the Tabora line. The link and Tanga lines have much lighter traffic, under 100,000 ton km per km, and the other two branches under 50,000. In comparison with other systems, even the 500,000 main line figure is not heavy.

A few major traffic flows can be noted briefly. Petroleum and cement move on all lines; all petroleum moves by rail beyond Morogoro in rail territory with minor exceptions; grain, Dodoma to Dar es Salaam (Dar); sugar, Kigoma to Dar; cotton and cattle cake, Mwanza to Dar; fertilizer, Dar to Tabora, and on the Tanga line; sisal, Morogoro to Dar and Moshi to Tanga. Traffic is well balanced, but 20% consists of petroleum and cattle, requiring equipment in which return loads cannot be handled.

In a sample month (June 1978), petroleum yielded 16% of total freight revenue and grain 10%; there was then a sharp drop to 7 for cement, 6 for coffee, 4 for livestock and 4 for Tobacco. No other product exceeded 1% — though general miscellaneous freight, which includes most manufactured goods, yielded 46%.

Major truck routes are those between Dar, Iringa and Mbeya, and Dar and Tanga to Arusha. There is little effective truck competition to the western portion of the central line as there are virtually no roads.

Passenger Fares and Traffic

Passenger fares were based on a straight distance basis: 147.00 + 1.5250 per km, first class; 73.00 + 0.6740 per km, second class; 49.00 + 0.5040 per km, second class sitting; and 22.00 + 0.2310 per km, third class. Thus a 500 km third class ticket cost TS 137.50 or about US. $3.273. Comparable fares for specific points were as follows (in Tanzania shillings).

RAIL

	1st Class	3rd Class	BUS	AIR
Dar es Salaam to				
Morogoro	485	75	198	—
Tabora	1465	225	—	—
Arusha	1155	175	—	—
Mwanza	2045	310	—	—

Thus, third class rail is the cheapest, bus being about the same as second class rail. First class is about 6 times third class, and air about 2½ times first class rail, and 8 to 12 times third class rail. The problem is that reservations on rail are difficult to get, often requiring a month in advance. The unreserved third class cars on the secondary mixed train are very crowded.

Passenger traffic, which yields 18% of total revenue, a comparatively high figure, is heaviest on the Dodoma-Tabora portion.

The Decline in Traffic Volume.

While detailed figures year-by-year are not available, it is clear that the total volume of freight and passenger traffic has declined by about 7% a year since 1972. In that year, total tons of freight carried was 1.680 million; in 1979 it was 850,000 and the 1982 figure is still lower. Passengers carried in 1972 were 4.2 million compared with 1.8 million in 1979. The railroad is estimated by CIDA to handle about 43% of the total freight transport, compared to 54% by road and 3% by water. Rail handles about 32% of passenger travel. While some of the loss may be due to the closing of the border with Kenya, most of the decline is by all indications the product of one cause: the inability of the railway to handle all the traffic available.

The CIDA study concludes that the railway handles only 48% of the traffic available to it. The following percentages show the portion of the total traffic that trucks have obtained simply because of inability of the railroad to move it: petroleum products, 50%; cement, 64%; grain, 72%; sugar, 83%; coffee, 24% and fertilizer, 70 % . The result is a substantial loss to the economy in form of higher costs estimated to be TS 220 million in 1979, and a heavier drain on foreign exchange.

Revenue and Earnings

It is impossible to carry revenue information back beyond 1975 since the figures are not entirely accurate, but Table 5 gives a picture of the general trends.

Table 5

Financial Statistics, Tanzania Railways, 1975-79

millions of Tanzania shillings

Category	1975	1976	1977	1978	1979
Revenues	290.7	329.6	336.5	323.2	360.3
Operating Expenses	206.4	183.7	322.7	336.0	297.2
Operating Margin	84.3	145.9	13.8	-12.8	63.8
Depreciation	35.0	35.0	35.0	33.3	60.8
Interest	30.0	30.0	30.0	11.6	28.4
Net Earnings	19.3	80.9	-51.2	-57.7	-25.3

Thus, though revenue has increased despite the loss of traffic because of higher rates it has fallen in real terms. The line showed a net profit in 1975 and 1976, deficits in the next three years, but an operating profit (not including depreciation) in all years except 1978. Thus, the financial picture is not different from those of most African lines. The problem, as noted, has been the inability to handle more than half the traffic available, resulting inthe use of much expensive road transport, greater foreign exchange drain, further destruction of roads, shortages of goods up-country, and inability to move out export crops. Road transport itself has had many problems centering around shortages of fuel, parts, and bad roads — and thus a considerable portion of the traffic that the railroad cannot handle simply does not move at all.

Causes of the Problems

The basic situation is one of serious underutilisation of the line. Old as the track is, it is not in hopeless condition. While it is impossible to measure the relative effects of various difficulties, the CIDA report and discussions with CIDA personnel suggest the following sources of the problems:

1. *Communications.* Perhaps the most serious trouble is bad communications within the yards and between stations and trains with no good central traffic control. It is difficult for personnel in the major yards to communicate with one another and no-one knows exactly where trains are. The token system is very effective in preventing collisions, but it slows down service, particularly when something goes wrong with communications lines connecting the stations.
2. *Poor ballast.* Most of the system has rock ballast, but it has deteriorated seriously. This is the prime cause of slow orders, thus resulting in substantial lapsed time and adding to cost and poor service.
3. *Congestion at Kigoma and Mwanza,* resulting in serious delays and poor utilisation of equipment. The problem arises with the translake traffic to Bukoba and Musoma in Tanzania, and to Uganda, Burundi, Rwanda, and Zaire. While Uganda traditionally shipped through Kenya with which it has direct rail connections, political considerations since the overthrow of Amin have increased preference for shipping via Tanzania.

The difficulty is that the ships on the lakes and the transshipment facilities are hopelessly inadequate. Only one vessel can handle freight cars. There is no "bridge" at Bukoba for running the freight cars off the ship (there is at Musoma, one of the few towns in the world with railroad tracks but no rail connection to the outside world). The remainder of the freight has to be unloaded from the rail cars and transferred to ships; this is a very slow and laborious process, particularly because the ships are old and careful balancing of cargo is necessary.

4. *Lack of adequate equipment maintenance facilities.* This has been a serious handicap in past years for both diesels and freight cars. The completion of the new facilities at Morogoro should help this work materially, although this was not considered the ideal location for the shops and trained personnel are not yet available.
5. *The problem, common in all African countries, of lack of trained personnel, in management and many aspects of operation, including equipment maintenance.* Thus, overall control of the system has been inadequate as well as some specific aspects of work.
6. *Shortage of freight cars;* aggravated by the slow orders and the port congestion.
7. *Shortage of spare parts;* resulting from lack of foreign exchange.

Proposed Changes

The CIDA study and similar work by SIDA, the Swedish aid organisation, on the Tanga line, offer a number of priority proposals, in some of which the aid organisations have provided assistance.

1. Specifically, CIDA proposes, for the central line, an investment of US $ 780 million over the next 20 years, of which, in millions, $280 would go for freight cars, $92 for locomotives, $75 for passenger cars, and $140 for track improvement. The estimated rate of return is 15%. More specifically, major proposals include the following ;

(a) Major track restoration, including the replacement of all rail on the central line by 80 pound rail, replacement of light rail by 60 pound rail on other lines, new sleepers, and complete reballasting.
(b) Improvement of communications, with stress on microwave, to facilitate train movements and control over equipment.
(c) A series of steps to end the congestion at the lake ports including ultimately, additional car ferries.
(d) Improved training facilities.
(e) Additional locomotives, freight cars, and passenger cars, as noted above.
(f) Additional repair facilities.
(g) Experimentation with concrete sleepers.
(h) General improvement of control facilities to improve car and locomotive utilisation.
(i) Priority importation of spare parts.
(j) Higher rates.

Longer range consideration include possible conversion of gauge to the 1.067 meter gauge of the other southern and central African lines. It is impossible to lay a third rail as only 2⅜ inches would separate the two. Thus the change would have to be made all at once. This would allow interchange of equipment with TAZARA and with the lines in Zaire (although TAZARA coupler s are different), but would make it impossible to restore interchange with

the Kenya-Uganda lines unless they change as well. Cost is estimated at about $85 million.

2. Consideration of building a new line from Arusha to Musoma, thus lessening pressure on the cross lake transfer and increasing potential service to Uganda.

Canada has provided substantial assistance, with management and technical advice, training and financing of equipment and tract improvement. Sweden has aided on the Tanga line.

Government Policy

The Government of Tanzania, in its recent *Structural Adjustment Programme*[4] designed to move the country out of its economic malaise, stresses improvements to the railway. A key element in the programme is to maximize use of the railways inorder to lessen the use of more expensive road transport and foreign exchange drain, thus planning for rehabilitation of the railway and an attempt to make greater use of TAZARA. A Ministry of Agriculture report, *National Food Summary*[5] concludes "The railway represents the cheapest means of transport but the total haulage is way below the potential. Both TAZARA and Tanzania Railways are in urgent need of rehabilitation". Among specific suggestions is one to shift fertilizer transport from road to rail

Conclusion .

Table 6 summarizes basic data for the three systems plus those of Zimbabwe and the Sudan, although information on all categories is not available for all lines. The Sudan system is the largest in terms of mileage, excluding the Zimbabwe system with three times the ton/km of the Sudan railways. Thus it has by far the highest traffic density — 1,800,000 ton/km per km. It likewise has so far the highest number of ton/km per employee, 8 times as much as the Tanzania and Sudan systems, and about one-fourth as great as in the United States, despite the lower traffic density compared to the U.S. Sudan Railways has by far the greatest number of employees and the greatest number per kilometer. Some of the advantages of Zimbabwe Railways are a product of the heavier traffic density, but some obviously reflect a difference in the training of employees and the overall efficiency of operation. Data are not sufficient to allow separation of the relative influence of these various items.

In general, on the basis of studies in other countries, the traffic density on all systems is high enough to allow reasonably low cost operation although not nearly as low as it would be if the lines had the traffic density of the major routes in the US. But none of the systems has density as low as the lowest traffic lines in the US, though a few individual branches in some countries do.

The earnings pictures do not differ as much as might be expected. The Zimbabwe and Tanzania lines show an operating profit after depreciation; the Sudan and Zambia lines show a small deficit. In no case are the railroads a serious drain on government tax revenues. But when interest costs are considered as well, none of the systems show a profit. Zimbabwe Railways show the largest deficit, equivalent to about US $45 million, and the Sudan system about US $18 million. The Tanzania figure is roughly $3 million (any attempt at conversion to a common denominator suffers from the non-free-market-exchange-rates problem). But the governments, while preferring to avoid these deficits, typically regard them as inevitable if the railroads are to make maximum contribution to economic development.

Table6 Summary Data, Railways of Four African Countries

Railway	Km	Locom	Freight Cars	Freight Tons Carried 000	Freight Net ton/km 000,000	Traffic Density ton/km per km 000	Employees	Employ per Kilom	Ton km/ per Employ	Rail % of Total Freight Traffic	Operat Profit 000,000	Operat Ratio	Overall Earnings or Deficit 000,000
National Rys of Zimbabwe (1982)	3,400	362	13,000	11,000	6,610	1,808	20,000	5.9	330,500		Z $20.3	89	US$-45.m
Zambia Railways (1976, 1981)	1,100	89	2,980	2,600	920	836	7,800	7.1	117,948		-K 1.9		
TAZARA (1978)	1,885	100	2,200	1,000	900	477	10,000	5.3	90,000				
Tanzania Railways (1979)	2,800	116[1]	3,800	850	650	212	16,000	5.7	40,625	43	+ Ts 2.3[3]	82	US $-3.0
Sudan Railways (1982)	4,756	250[2]	6,204	1,630	1,908	401	35,310	7.4	46,176	33	Ls – 3.7[3]	106	US £-18.0
Total	13,950												

1 Plus 63 steam, not used in line service

2 Plus 96 steam used for switching only

3 After depreciation

Sources:
Zimbabwe, Monthly Digest of Statistics, August 1982, Sudan, Transport Statistical Bulletin, 1982, Tanzania, Canadian International Development Agency, Transport Sector Study: Zambia and Tazara, primarily from CIDA (Tanzania) Transport Stud y; Bank of Zambia, Annual Report, 1981.

A major feature in all of the countries except Zimbabwe is the inability to handle all traffic available; the CIDA estimate in Tanzania is that the railroad can handle only about half of the traffic that would be available to it. There are frequent references to this problem in the Sudan, and Zambia has, for example, asked that maize coming up from the south be shipped by road rather than rail because of lack of rail capacity.

There are several reasons, much the same in the various countries; especially in Tanzania and the Sudan: poor track conditions, mainly ballast and poor communications for control of trains; inadequate equipment maintenance, arising from lack of spare parts and trained personnel; and general shortages of management and technical personnel in all four countries. The relatively poor service arising from these same sources causes further loss in traffic and poorer utilisation of equipment.

Especially in Sudan on the major Port Sudan-Khartoum route, and to some extent in Zimbabwe, traffic in manufactured goods has been lost because of the values of service nature of the tariffs. Only Tanzania has shifted from such a tariff to one based on cost of handling.

While it is difficult to come up with adequate comparative data, there is strong evidence in all four countries that rail costs are lower than road transport costs except on short distances — under 100 to 200 km. The most careful study available, by CIDA in Tanzania, shows that road transport costs are three to seven times that of the rail costs. Rail transport likewise places substantially less drain on foreign exchange, per ton/km of traffic.

Passenger service remains of some importance; volumes have fallen primarily because of inadequate capacity. Third class fares are very low by any standards — but cars are crowded and standards have fallen, except on the main line passenger trains in Zimbabwe.

Steam locomotives have been phased out except for some switching service in Tanzania and the Sudan; only Zimbabwe has rebuilt and retained in service a number of coal burning locomotives for main line service. The heaviest traffic line in that country, one of the heaviest in Africa, is being electrified. Rail, most of which is light by US standards, ranging from 45 lb. per yard to over 100, is gradually being upgraded, 56 to 80 on main lines in Tanzania and 75 to 90 in the Sudan.

The governments, without exception, place strong emphasis on the importance of improved rail service, and considerable World Bank and foreign donor aid have been obtained to improve the systems. The future of rail transport in Africa depends in large measure on the ability of the rail systems to improve efficiency and increase their carrying capacity and to revise their tariffs to avoid loss of high value merchandise traffic. The governments, in addition to providing financial asistance, can aid in attaining an optimal balance between rail and road transport by adequate user charges on road transport, prevention of overloading, and concentrating road construction over the next decade on feeder roads rather than on ones paralleling rail lines.

References

1. Two articles by the author in 1979 and 1980 covered a somewhat larger number of countries and were based on data up to 1976 for the most part: John F. Due. "The problems of Rail Transport in Tropical Africa,"', *Journal of Development Area,* Vol. 13 (July 1979), pp. 37593, and "The Economic Viability of the Railways of Tropical Africa", *Journal of Development Economics,* VOl. 7 (June 1980), pp. 263-72. Material in these articles is not included in this paper with minor exceptions.

Other earlier references include Anthony M. O'Connor, *Railways and Development in Uganda,* East African Institute of Social Research, East African Studies 18 (Nairobi: Oxford University Press, 1965); Rolf Hofmeier, *Transport and Economic Development in Tanzania* (Munich; Weltforum Verlag, 1973); Alan R. Prest, *Transport Economics in Developing Countries* (New York: Praeger, 1969); Arthur Hazlewood, *Rail and Road in East Africa* (Oxford: Basil Blackwood, 1964).

2. *Tanzania Railway Transport Study,* 12 vol., Dar es Salaam and Ottawa, May 1981. This section is based primarily on the CIDA report and discussions with CIDA personnel.

3. CIDA study of truck costs shows that with 80% capacity use, costs are 65 TShs per t/km with paved roads, .91 TShs. will earth roads.

4. Tanzania, Ministry of Planning and Economic Affairs, *Structural Adjustment Programme for Tanzania,,* Dar es Salaam June 1982, pp. 2831.

5. Tanzania Ministry of Agriculture, *National Foods Survey,* Dar es Salaam, May 1982, p. 19

Fig 1 ***Some Railway Systems in Central Africa-***